

Amendment and Response

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Serial No.: 10/081,176

Confirmation No.: 2734

Filed: February 22, 2002

For: SEPARATION APPARATUS AND METHODS

Remarks

The Office Action mailed June 30, 2004 has been received and reviewed. Claims 1-3, 11, and 16 have been amended. Claims 19-44, previously withdrawn from consideration, have been cancelled. New claims 45-68 have been added. Therefore, the pending claims are claims 1-18 and 45-68. Reconsideration and withdrawal of the rejections are respectfully requested in view of the amendments and remarks provided herein.

Claim Amendments

Claim 1 has been amended so as to include the limitation of "discharging separated magnetic material via an underflow outlet located proximate the lower region of the container during separation of magnetic material from the non-magnetic material." In other words, magnetic material of the slurry is discharged as the separation process is occurring. For example, in at least one embodiment, the magnetic grid is used to prevent magnetic particle suspensions from passing through the grid. The magnetic particle suspensions, prevented from passing through the grid, are removed as an underflow during operation of the system. The attachment of magnetic particles to the grid is undesirable. However, the attachment of some magnetic particles is unavoidable in many circumstances.

Claim 2 is amended to delete language used for providing antecedent basis when amending claim 1.

Claim 3 has been rewritten in independent form including all the limitations of the base claim from which it originally depended. This claim has not been narrowed in any manner.

Claim 11 has been rewritten in independent form including all the limitations of the base claim from which it originally depended. This claim has not been narrowed in any manner.

Claim 16 has been rewritten in independent form including all the limitations of the base claim from which it originally depended. This claim has not been narrowed in any manner.

Claims 45-68 are new dependent claims which are based on dependent claims originally dependent, either directly or indirectly, on claim 1, but which are dependent on the rewritten independent claims 3, 11, and 16.

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The 35 U.S.C. §103 Rejection

The Examiner rejected claims 1, 4 and 7 under 35 U.S.C. §103(a) as being unpatentable over Wheelock (U.S. Patent No. 3,850,811). The Examiner further rejected claim 2 under 35 U.S.C. §103(a) as being unpatentable over Wheelock (U.S. Patent No. 3,850,811) as applied to claim 1 above, and further in view of EP 0510849 A2. Applicant respectfully traverses the Examiner's rejections. However, to move the case to issuance, claim 1 has been amended as described above to clarify the claimed invention. An additional element has been added to the claim for such clarification.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references must teach or suggest all the claim limitations. See M.P.E.P. § 2143.

U.S. Patent 3,850,811 and EP 510849 do not teach or suggest all the claim limitations recited in claim 1. Further, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine the reference teachings to arrive at the subject matter recited in claim 1.

U.S. Patent 3,850,811 and EP 510849 both deal with the use of grids as filters in removing magnetic particles and their designs require provisions for removing retained magnetic particles attached to grids by backflushing. For example, at least in U.S. Patent 3,850,811, magnetic fields at gaps provide collection points for magnetic particles, thereby trapping and filtering out magnetic particles. Thereafter, backflushing is used for removing the trapped particles.

Further, for example, U.S. Patent 3,850,811 describes a design that includes parallel plates. The surfaces of parallel plates do not serve the purpose of a filter because there is no field gradient. With converging magnetic fluxes at the gaps of the plates, magnetic particles are

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captured when the flow direction changes. Capture efficiency and the ease of backflushing are the main considerations as described therein. To increase the capture efficiency, the plates are arranged in a zigzag pattern.

Yet further, EP 510849 describes an alternative to high-intensity magnetic separation without using electromagnets. A major objective is to arrange the grid structure in EP 510849 to maximize the filter efficiency. Spacial arrangements of grid openings are needed to overcome the problem of cleaning the filter by backflushing when the collectors become loaded with magnetic particles. For example, Figures 1 and 3 show grid structures with an ordered array of holes with some holes occupied by magnets and other holes not occupied by magnets. The ordered array of holes allows fluids to pass through the filter. Multiple subsections of grid structures are repeated with some spaces in between, and a distributed pattern of collectors and fluid flow apertures is needed, thereby providing meandering fluid flow paths through the filter, both aiming at maximizing the capture efficiency. When the retention capacity of the grids are used up and the loaded grids need to be cleaned, backflushing by high pressure fluid jets and/or mechanical scrubbers is necessary.

According to claim 1 of the present invention, a method for separating magnetic material from non-magnetic material is described. The method includes providing a container with the container extending along an axis from a lower region to an upper region. A slurry is directed into the container through a slurry inlet, wherein the slurry comprises magnetic material and non-magnetic material. At least a medium (e.g., a liquid or a gas) is used to separate the magnetic material from the non-magnetic material, wherein a portion of the magnetic material is transported with non-magnetic material along a path by at least the medium toward an overflow outlet (e.g., the overflow outlet is located proximate the upper region of the container). A magnetic grid defining a plurality of openings is positioned in the path of the transported magnetic material. The magnetic grid prevents at least a portion of the transported magnetic material from passing through the plurality of openings to the overflow outlet. Separated magnetic material is discharged via an underflow outlet located proximate the lower region of the container during separation of magnetic material from the non-magnetic material.

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For example, in one embodiment, the magnetic grids are used to prevent magnetic particle suspensions from passing through the grids. The magnetic particle suspensions, prevented from passing through, are removed as an underflow. The attachment of magnetic particles to the grid is undesirable, but unavoidable, and some magnetic particles remain on the grid in the continuous operation. However, even with such magnetic particles on the grid, discharge of other magnetic particles prevented from passing through the grid are discharged as the separation process occurs (e.g., as described in the specification, 8-inch square openings are used in the flotation cell to prevent a portion of transported magnetic material from passing through the grid).

U.S. Patent 3,850,811 and EP 510849 do not teach or suggest that a medium (e.g., a liquid or a gas) is used to separate the magnetic material from the non-magnetic material as described in claim 1. Further, such references do not teach or suggest that the separated magnetic material is discharged via an underflow outlet located proximate the lower region of the container during separation of magnetic material from the non-magnetic material.

For example, U.S. Patent 3,850,811 and EP 510849 both describe filters used to capture magnetic particles and their designs require provisions for removing retained magnetic particles attached to the filter grids by backflushing. As such, discharge of magnetic material via an underflow outlet located proximate the lower region of the container during separation of magnetic material from the non-magnetic material could not be provided because (in both U.S. Patent 3,850,811 and EP 510849) separation as described therein (e.g., capture of magnetic material by the filter grid) must be stopped for such discharge to occur (e.g., in order to perform backflushing).

For at least the above reason, claim 1 is not obvious in view of the cited references.

Further, as claims 2, 4, and 7 depend on claim 1, either directly or indirectly, they include the limitations thereof. As such, these claims are also not obvious over the cited references for the same reasons as provided above and by reason of their own limitations. For example, the cited references do not show a magnetic grid that defines rectangular shaped openings as described in claim 7 (e.g., U.S. Patent 3,850,811 shows various spaced parallel strips and EP

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510849 shows magnetic particle collectors positioned in a grid but not a "magnetic" grid that defines rectangular openings).

Allowable Subject Matter

Applicant further acknowledges that claims 3, 5-6, and 8-18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. However, Applicant has not rewritten claims 5-6, claims 8-10, or claims 13-15 at this time, but reserves the right to provide such claims in independent form at a later date during prosecution of this application, if desired.

Claim 3 has been rewritten in independent form including all the limitations of the base claim from which it originally depended. Further, new claims 45-52 have been added which depend thereon. It is believed that such claims, by virtue of at least their dependency, are in allowable condition.

Claim 11 has been rewritten in independent form including all the limitations of the base claim from which it originally depended. Further, new claims 53-61 have been added which depend thereon. It is believed that such claims, by virtue of at least their dependency, are in allowable condition.

Claim 16 has been rewritten in independent form including all the limitations of the base claim from which it originally depended. Further, new claims 62-68 have been added which depend thereon. It is believed that such claims, by virtue of at least their dependency, are in allowable condition.

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Summary

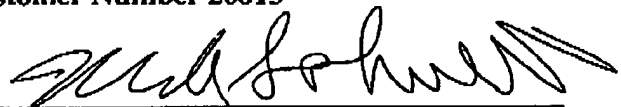
It is respectfully submitted that the pending claims are in condition for allowance and notification to that effect is respectfully requested. The Examiner is invited to contact Applicant's Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully submitted for
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October 26, 2004
Date

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CERTIFICATE UNDER 37 CFR §1.8:

The undersigned hereby certifies that the Transmittal Letter and the paper(s), as described hereinabove, are being transmitted by facsimile in accordance with 37 CFR §1.6(d) to the Patent and Trademark Office, addressed to Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 26th day of October, 2004, at 1:45 pm (Central Time).

By: 
Name: Sue Dombroske